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THE SPECTRA OF THREE M-TYPE STARS WITH BRIGHT LINES

T CORONAE: MAGNITUDE 9.5

At the suggestion of Professor Russell the spectrum of *T Coronae*, the nova of 1866, was photographed with the 100-inch telescope on July 17, 1921. Another spectrogram of lower dispersion but of greater effective exposure was obtained on August 19th.

The spectrum is a most interesting one. The absorption spectrum is of type Mb with strong titanium oxide bands. The hydrogen lines $H\beta$ and $H\gamma$ are bright and very broad, the latter probably showing a dark reversal but with the violet component much the stronger. $H\delta$ is an absorption line. The most interesting feature is the presence of the bright helium line at $\lambda 4686$ so characteristic of Wolf-Rayet stars. It resembles $H\beta$ in appearance.

The radial velocity of the star as derived from the absorption lines is -5 km. The bright lines $H\beta$, $H\gamma$, and $\lambda 4686$ are displaced toward the violet relatively to the absorption lines by about 1.3 Å.

BOSS 5650, H. R. 8383: MAGNITUDE 5.4.

The spectrum of this star has been given by Miss Cannon as Md with all the hydrogen lines bright, $H\beta$ being the strongest observed. The star was found by the Harvard observers to show a variation of from one-quarter to one-half a magnitude in brightness.

Observations of the spectrum were made at Mount Wilson as early as September, 1914. In addition to the bright lines of hydrogen which show a very unsymmetrical reversal, the violet component being much the stronger, bright lines are present at $\lambda\lambda 4233$, 4244, 4287, 4515, 4583, 4924 and 5018. Most of these are enhanced lines of iron. The absorption spectrum of the star is of type Ma.

The most interesting feature of this spectrum is the displacement of the different spectral lines. A variation in velocity of about 25 km is shown by the absorption lines upon the various spectrograms. The bright lines other than those of hydrogen show a displacement toward the violet with reference to the absorption lines of about 1.3 Å. The narrow absorption lines of hydrogen show systematic displacements as compared with the other absorption lines which vary from $+0.4$ Å on the earlier photographs to -0.3 Å on the more recent ones, and the bright components of the hydrogen lines share in this variation. The effect is seen very clearly on two spectrograms taken with comparatively high dispersion on November 1, 1917, and August 20, 1921. The hydrogen

lines as a whole, including both bright and dark components, show a change of displacement in reference to both the bright and the absorption lines in the spectrum.

C. D. M. $-33^{\circ}16843$: MAGNITUDE 8.0

In a letter from Miss Cannon to one of us attention was called to the spectrum of this star, which is of type Ma with bright hydrogen lines, altho the star showed no variation in magnitude. In some respects it is similar to that of Boss 5650, but the bright hydrogen lines are comparatively narrow and resemble those in the ordinary Md variables. $H\gamma$ is somewhat stronger than $H\beta$, and $H\delta$ is much fainter than either. There appear to be no other bright lines in the spectrum with the possible exception of $\lambda 4584$ and one or two others. The bright hydrogen lines and the absorption lines give nearly, if not quite, the same radial velocity.

W. S. ADAMS,

A. H. JOY.

TEN STARS OF CLASS B HAVING THE $H\alpha$ LINE BRIGHT
THIRD LIST¹

$H\alpha$ has been observed as an emission line in the spectra of the stars in the following list, on photographs made with the 10-inch Cooke refractor and 15° objective prism on the dates indicated. The general appearance of these spectra is illustrated by Figures 2, 4, and 5 of Plate X of these PUBLICATIONS for December, 1920.

The observations marked "100-inch" or "60-inch" were made with a single-prism slit spectrograph attached to one of the large reflectors, and are of the usual photographic region with the exception of the plates of χ^2 *Orionis* which are of the $H\alpha$ region.

¹Previous lists appear in these PUBLICATIONS **32**, 336, 1920; **33**, 112, 1921.

STAR	R. A. 1900	Dec. 1900	Spect.	Mag.	Date	Observer
D M +62°271.....	1 ^h 27 ^m .9	+63° 7'	B5	8.2	1920 Sept. 18	H
					Oct. 26	H
D M +54°398.....	1 45 .9	+54 50	B1	8.6	1921 July 26	H 100 inch
					1920 July 18	H
					Dec. 18	H 60 inch
H D 33461.....	5 5 .3	+41 6	B3	8.0	1921 Aug. 25	H 100 inch
					1920 Dec. 29	H
H D 39340.....	5 46 .9	+26 25	B3	8.1	1921 Jan. 4	H 100 inch
					1921 Feb. 8	H
D M +25°1019.....	5 47 .3	+25 43	B3	8.5	1921 Mar. 10	H 100 inch
					1921 Feb. 8	H
					Mar. 30	H 100 inch
χ ³ Orionis.....	5 58 .0	+20 8	B2p	4.7	Apr. 10	H 100 inch
					1921 Feb. 7	H
					Feb. 19	H
					Feb. 24	H 2 plates
					Feb. 28	M 60 inch
					Mar. 30	H 100 inch
D M +20°1309.....	6 6 .3	+20 7	B	9.1	1921 Feb. 8	H
					Mar. 30	H 100 inch
H D 44637.....	6 17 .7	+15 9	B5	7.7	1921 Mar. 30	H
					Feb. 27	M 100 inch
H D 45314.....	6 21 .6	+14 57	Oe5	7.1	1921 Feb. 8	H
					Feb. 26	M 100 inch
H D 50209.....	6 47 .1	— 0 10	B8	8.3	1920 Dec. 10	H
					Dec. 30	H 100 inch
					1921 Jan. 4	H 100 inch

NOTES TO THE TABLE

D M +54°398—The absorption lines are very weak.

H D 33461—The bright portions of $H\beta$ and $H\gamma$ are very weak.

χ^2 *Orionis*—On the 10-inch plates the bright $H\alpha$ is a difficult and somewhat uncertain feature because of its slight contrast with the continuous spectrum. Its presence is clearly shown, however, by the slit spectrograms made on February 28th and March 30th. The other hydrogen lines seem to have no bright portions. The star is a spectroscopic binary, *Lick Observatory Bulletins* 6, 144, 1911. Its spectrum contains a large number of well defined absorption lines. Remark in *H D*: "The lines are narrow." A description of the spectrum has been published by Henroteau, *Publications of the Dominion Observatory*, Ottawa, 5, 21, (No. 1), 1920.

D M +20° 1309—The slit spectrogram is underexposed but the spectral class is perhaps B3. A bright $H\beta$ is clearly shown.

H D 44637—Remark in *H D*: "The line $H\beta$ is not clearly seen and is suspected to be bright."

H D 45314—The H and K lines are sharp.

H D 50209—The slit spectrograms are underexposed. The bright portion of $H\beta$ is narrow and weak.

MILTON L. HUMASON,
PAUL W. MERRILL.

SUMMARY OF MOUNT WILSON MAGNETIC OBSERVATIONS OF SUN-
SPOTS FOR JULY AND AUGUST, 1921

The increased activity of June continued thru-out July, but August was much less active. During July there were no spotless days and on the average 3.5 groups were observed daily. In August there were five spotless days and the daily average was 2.0 groups.

MAGNETIC CLASSIFICATION OF SUN-SPOTS FOR JULY, 1921

No.	C. M. P.	Lat.	H	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	
1864	June 20.7	- 7°	20	βp	βp	βp	βp	x											
1865	30.2	+14	18	αp	αp	αp	x												
1866	July 1.1	+14	22	βp	βp	βp	βp	αp	$\beta \gamma$	γ	γ	γ	γ	γ	x				
1867	6.2	+ 5	25	αp	αp	$\beta \gamma$	$\beta \gamma$	$\beta \gamma$	$\beta \gamma$										
1868	3.9	- 9	10	x	x	x	x												
1869	7.3	+12	28	αp	αp	αp	αp	βp	βp	βp	αp	αp	αp	αp	αp	x			
1870	6.1	+ 9	14	αp	αf	αf	βf	βf	x										
1871	6.9	+ 8	11	βf	x			αp				βp	βp	βp	βp	βp	αf	x	
1872	5.1	+12	5									βp	βp	βp	βp	βp	αf	x	
1873	8.2	-15	26									β	βp	βf	βp	βp	βp	βp	
1874	11.8	+ 3	25																
1875	16.9	- 5	27																
1876	13.2	+14	13																
				7	8	7	7	6	5	2	4	4	4	4	5	5	3	2	
No.	C. M. P.	Lat.	H	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
1875	July 16.9	- 5°	27	βp	βp	βp	βp												
1877	21.8	-11	13				β												
1878	23.3	+13	2				x												
1879	24.8	- 5	5				x												
1880	26.0	- 5	11						α	α	α	α							
1881	23.5	-11	5						α		βf	αf	β	αp	βf	βp	βp	βp	βp
1882	21.0	-17	18						α				β	βp	βp	βp	βp	βp	βp
1883	28.6	+12	17										βp	βp	βp	βp	βp	βp	βp
1884	30.2	- 9	36										β	βp	βp	βp	βp	βp	βp
1885	Aug. 1.5	+12	x										β	βp	βp	βp	βp	βp	βp
1886	July 28.0	+12	6										β	βp	βp	βp	βp	βp	βp
1887	28.3	+15	2																
				1	1	1	4	2	1	2	2	3	3	2	2	4	2	2

MAGNETIC CLASSIFICATION OF SUN-SPOTS FOR AUGUST, 1921

No.	C. M. P.	Lat.	H	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1884	July 30.2	- 9°	36	$\beta\gamma$	$\beta\beta$	$\beta\beta$	$\alpha\beta$					β		$\beta\beta$	$\beta\beta$	$\beta\beta$	$\alpha\beta$	$\alpha\beta$
1887	28.3	+15	2	x	α												$\alpha\beta$	x
1888	Aug. 7.3	+10	3														$\alpha\beta$	x
1889	12.2	0	27														$\alpha\beta$	x
1890	18.5	+ 5	11														$\alpha\beta$	x
1891	9.8	- 5	x														$\alpha\beta$	x
1892	21.5	- 5	29														$\alpha\beta$	x
				2	2	1	1	.....	.....	.....	.....	1	.....	1	1	2	3	3

No.	C. M. P.	Lat.	H	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
1889	Aug. 12.2	0°	27	$\alpha\beta$	$\alpha\beta$	$\alpha\beta$	$\alpha\beta$	$\alpha\beta$	$\alpha\beta$	$\alpha\beta$	$\alpha\beta$	$\alpha\beta$	$\beta\beta$						
1892	21.5	- 5	29	x	$\alpha\beta$	$\alpha\beta$	β	$\beta\beta$	$\beta\beta$	x									
1893	16.4	-15	17																
1894	24.7	+12	15																
1895	21.0	-10	19																
1896	27.1	+12	35																
1897	22.9	+12	23																
1898	25.4	+13	x																
1899	28.3	-10	23																
				2	2	3	2	2	4	5	3	4	3	2	3	3	3	2	2

NOTES

- No. 1866 A return of No. 1851.
- No. 1867, 1869, 1870, 1871, 1872. These groups were all in the same disturbed area, which was a return of the region containing No. 1852, 1853, 1854, 1857, 1859.
- No. 1867 When this group came around the east limb it consisted of a regular spot with a positive polarity followed by several small spots irregularly distributed with regard to polarity. One of the negative spots developed in size and at the same time moved west with reference to the positive spot, passing it three degrees to the south about July 6.6 G. M. T. After that time it was the preceding member of the group.
- No. 1868 The preceding spot was negative on July 1 and 2, but the polarities of the faint following spots were not determined. The group was probably $\beta\beta$.
- No. 1869 The principal member of this group was a large composite spot with two umbrae both of positive polarity. The large spot divided into two regular spots which continued to separate.
- No. 1876 This was a negative spot in the northern hemisphere.
- No. 1885 This group consisted of two small spots which had the appearance of a bipolar group, but both spots were negative.
- No. 1887 A small spot in the northern hemisphere with negative polarity. The spot was near the west limb and the polarity was observed on only one day.
- No. 1889 This group developed rapidly between August 10^d 10^h and August 11^d 2^h 30^m G. M. T. On August 11th it was south of the equator but its polarity was that of a northern group. It drifted rapidly to the north, crossed the equator on August 12th and was then a regular northern group.
- No. 1890 A small regular spot near the east limb. Polarity observations were made on two days by different observers; a case of irregular polarity.
- No. 1894 No spots were observed in this region on August 23rd, but on August 24th a spot appeared in the preceding part of the calcium flocculi.
- No. 1896 This group went through rapid changes, developing from some small spot near the east limb to a group with an area of about 550-millionths of the visible hemisphere and then diminishing to a few small spots near the west limb.